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Effects of teacher-led educational intervention on knowledge and attitude towards the prevention of diabetes mellitus among students of a secondary school in Southern Nigeria: a single group quasi-experimental study

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ABSTRACT

INTRODUCTION: The widely documented poor knowledge of diabetes mellitus (DM) among adolescents is a lacuna in the current drive to decrease the prevalence of the disease. This study was designed to investigate the effects of teacher-led educational interventions on the knowledge, perception, and attitude towards DM among students of Dom-Domingos College Warri, Delta State, Nigeria.

METHODS: This pre-test post-test design study was conducted on 100 secondary school students of Dom-Domingos College in 2021, who were selected using the simple random sampling method. Data was collected using a validated questionnaire including demographic, knowledge, perception, and attitude sections. Afterward, an educational intervention was implemented among the students for three weeks in three hourly sessions. After one month, the data were recollected from the students and analyzed using mean, paired t-test, and logistic regression at $P<0.05$ level of significance by SPSS Version 17 software.

RESULTS: The mean age of the students was 13.95±1.92 years, and 59 (59.0%) were females. The majority of the students, 88 (88.0%), are aware of DM. The findings showed a significant increase in the mean knowledge, perception and attitude score in the post-test compared to the pre-test at $P<0.05$.

CONCLUSION: Teacher-led educational intervention effectively improves knowledge, perception, and attitude towards DM prevention among in-school adolescents. Therefore, the study recommends utilizing this opportunity by educational and health policymakers to increase messages of DM prevention in secondary schools in Nigeria.

Keywords: Adolescent, Diabetes Mellitus, Knowledge, Perception, Secondary School, Students.

INTRODUCTION

Diabetes Mellitus (DM) is a group of metabolic disorders in which the blood sugar is higher than normal (hyperglycemia). It is described as a serious chronic condition that occurs when there is a

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raised level of glucose in a person's blood [1,2]. DM is a disease that affects everyone across the globe irrespective of continent, region, race, socio-economic class and gender. DM is classified into Type 1, Type 2 (T2DM) and gestational diabetes (GDM), and other specific types known as secondary DM [1,3]. Pre-diabetes is another category of diabetes characterized by a condition defined as blood sugar levels higher than normal but not high enough to be diagnosed as T2DM [1,3].

Type 1 diabetes (T1DM), also known as insulin-dependent or juvenile-onset diabetes, is an auto-immune disease that causes the destruction of insulin-producing beta cells in the pancreas, preventing the body from adequately regulating blood glucose levels [4]. T1DM, which is common among adolescents, has been reported to be one of the most common chronic childhood diseases [5]. Currently, there is a growing prevalence of DM among children and adolescents. Diabetes was previously thought to be a disease of adults and the elderly and is gradually manifesting itself among children, teenagers, and adolescents in secondary schools in Nigeria [6-10]. However, Nigeria is one of the world's top five countries (together with Indonesia, the Philippines, Vietnam, and South Africa) without comprehensive incidence and prevalence data for type-1 DM data for < 20 years old [1].

Secondary school children or other adolescents living with DM of either type 1 or type 2, will find it difficult to successfully adapt to the management of the condition [11]. They may find themselves having difficulty in adjusting socially, feeling isolated and different from other children who may freely eat sweets, soft drinks, cakes and chocolates and who can undertake a wide range of physical sports and activities [12]. Instead, children with DM may find themselves constantly having to watch what they eat and drink when they eat and drink and a life-long commitment to monitoring and regulating blood sugar levels through a range of insulin therapy and other relevant medication and treatment, which is not easy for a child to adapt to [12,13].

A school is a place of learning and educating children in order to empower them with knowledge. Secondary school teachers occupy the role of the main carers of children in the school. The caring role becomes critically important when some of the children in their care have poor knowledge of the components of DM, as reported by studies in Nigeria [11,14]. Knowledge empowerment as a primary prevention strategy is to help the students make informed decisions to minimize their risk of contracting diseases. Teachers are a valuable tool for disseminating knowledge as they are the custodian of school children [15] and the first line for their protection within the school environment. One of the areas teachers could be empowered to leverage is to teach children about the prevention of chronic diseases such as DM, as a way of creating awareness of the disease and preventing the developing disease either at adolescent age or in adulthood, especially among children with family history of the disease. Thus, this study was designed to investigate the effects of teacher-led educational interventions on the knowledge, perception and attitude towards diabetes mellitus prevention among students of Dom-Domingos College, Warri, Delta State

METHODS

Study Design and Setting

The study design was an informal experimental design using the pre-test, post-test without control design to assess the effects of teacher-led educational intervention on the knowledge, perception and attitude towards the prevention of diabetes mellitus among students of Dom-Domingos College, Warri, from January to June 2021. The reporting was done using the Transparent Reporting of Evaluations with Non-Randomised Designs (TREND) statement checklist [16].

The study was carried out in Dom-Domingos College Warri, Warri South Local Government Area of Delta State. Dom-Domingos was founded in the year 1980, with 24 classes, 80 teachers, and a total of 2400 students at the time of the study.

Participants

The eligibility criteria were that teachers and students must be staff and students of Dom-Domingos College. Students must not be in exit classes of JSS 3 and SS 3. Teachers must teach any of the following subjects: Physical and Health Education, Biology, Basic Science, and give informed consent to participate in the study.

The study population was recruited from Junior Secondary School 1, Junior Secondary School 2, Senior Secondary School 1, and Senior Secondary

School 2 in Dom-Domingos College, Warri. Exit classes such as Junior Secondary School 3 and Senior Secondary School 3 were omitted from the study because they will not be available for follow-up after their final examinations. Teachers recruited for the study were those teaching Science related subjects such as Biology, Physical and Health Education, and Basic Technologies. This group of teachers was recruited as Training-of-Trainers because they already have prior knowledge of DM from the secondary school curriculum.

Sample Size Estimation and Sampling Technique

The sample size was estimated by using the formula for quasi-experimental study utilizing the pre and post-test or before and after-test study design [17].

$$n = \frac{(Z\alpha + Z\beta)^2 SD^2}{O^2} = \frac{1.96+0.84)^2 \times 3.612}{(2.94)^2} = 11.82$$

Where n= Minimum sample size, Zα= 1.96 if p=0.05, Zβ = 0.84 if power=80%, and SD is the standard deviation of the differences within pairs which is 3.61 gotten from a previous study [12].

δ = μ1 and μ2 are the means before and after intervention which is (15.18-18.12), which was obtained from a previous study [12].

10% nonresponse rate was added to the sample size by multiplying by adjustment factor q

q= 1/1-f

q= 1/1-0.1

q= 13.13

However, 100 students were sampled at the baseline of the study.

The sampling technique involves randomly selecting Dom-Domingos College, Warri, from eight public secondary schools in Warri South Local Government Area. Thereafter, the school was stratified into common units of classes (JSS 1, JSS 2, SSS 1, SSS 2). Subsequently, a simple random sampling technique was used to select 100 students from each of the classes at baseline. Teachers that fulfilled the inclusion criteria were recruited purposively.

Instruments

The instrument for data collection was a validated questionnaire adapted from a previous study [14,18], comprising four sections. Section one comprised the socio-demographic characteristics of the students. Section two contains questions on the students' knowledge of DM, and section three encompasses questions on the perception of DM. Section four was used to appraise their attitudes towards the prevention of DM. The questionnaire was administered at pre-test and post-test intervals.

To test the reliability of the questionnaire, a pre-test was conducted among 10% of the sample size in Amai Mixed Secondary School in Ukwuani Local Government Area of Delta State for revision of the instrument before commencing the main study. The internal consistency measure (Cronbach Alpha) of the instrument was used to determine the reliability of the instrument at pre-test and at post-test. The Cronbach Alpha score on the pre-test was 0.778 and on post-test was 0.991.

Intervention

The use of educational intervention programs to increase awareness of diabetes mellitus and support for children with the disease in many facets of their lives has been highlighted by the International Diabetes Federation [19]. The IDF recommends the development of educational programs about diabetes mellitus that cover in more detail the warning signs, symptoms, management, prevention, and treatment of the conditions for school personnel, including students. This majorly formed the content of the developed training guide for the study. The training guide was developed based on the identified gaps from baseline, literature search, IDF information pack for schools [20], IDF Kids and Diabetes in Schools pack, training book developed for DM peer educators training [21], and other available diabetes-related educational materials. The contents of the intervention were delivered through a flip chart for both teachers and students, consisting of the content of the training guide for each training session. Printed educational materials centered on DM, including its prevention and control, were used as teaching aid. The researchers used a group-based educational training session for the educational intervention both for the teachers and students. The health education intervention program consists of a range of activities, including lectures, group sessions, and discussions. The training was conducted within the school premises for both teachers and students. The teachers were trained by a trained nurse for two weeks in a three hourly session once a week. The trained teachers then trained the students for three weeks

in a three-hour session once a week. An IDF-developed PowerPoint material on DM causes, signs and symptoms, risk factors, complications, management, and prevention was given as follow-up materials to both the teachers and students.
The study's main outcome was the change in mean knowledge, perception, and attitude towards DM prevention among the students at the post-test when compared with pre-test.

Data collection

The initial stages of data collection include conducting Key Informant Interviews (KIIs) among teachers and Focus Group Discussions (FGDs) among students of Dom-Domingos College Warri. The aim of the qualitative data collection was to obtain in-depth opinions among teachers and students on the various components of DM. The findings of the qualitative study [22,23] and other available DM materials were used to develop a training guide which was used to train the teachers for two weeks in three hourly once in a week sessions starting with knowledge, management, and prevention of DM, who thereafter trained the students during the intervention as scheduled. The developed questionnaire was used to assess the knowledge, perception, and attitudes of students regarding DM at two stages. At baseline, a pre-test assessment of the knowledge, perception and attitude of students towards prevention of DM was conducted via a self-administered questionnaire in a group setting. Thereafter, three weeks of three hourly once a week session on DM prevention intervention was conducted by the trained teachers among the students using the developed training guide. The post-test data were collected among the students after a month of follow-up.

Data Analysis

The recorded FGDs and IDIs were transcribed verbatim and analyzed thematically for themes and content. The collected questionnaire for pre and post-test was cleaned, coded manually, entered into the computer and analyzed with Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics were used to present the data on frequency tables, charts, and mean scores of knowledge, perception, and attitude towards DM prevention. The paired sample t-test statistics were used to show the mean scores and standard deviations at both pre-test and post-test. The result of t-test was provided as paired differences which indicated the mean differences between pre-test and post-test scores, t-statistic, confidence intervals, and its associated significant value at $P<0.05$.

Measurement

A dichotomous knowledge scale was developed and used to quantify the overall level of knowledge of DM among the students. The sum of the number of test items in the knowledge section of the questionnaire was 17 items. A right answer was scored as 1, while a wrong answer was scored as 0. Therefore, every study participant's knowledge score was categorized between 0-8 as Code 1 and >8-17 as Code 2. Respondents that score between 0-8=Code 1 were adjudged to have exhibited poor knowledge of DM prevention, and >11-23=Code 2 as having good knowledge of DM prevention. The knowledge of DM definition and types of DM was measured on a 5-point scale categorized between 0-2 as poor knowledge of DM definition and types and >2-5 as good knowledge of DM definition and types. Furthermore, knowledge of DM causes, signs and symptoms, risk factors, complications, management, and prevention were all measured on a 2-point scale categorized as 0-1 as poor knowledge and 2 as good knowledge.

The Health Belief Model constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers) were used to measure DM's perception. To measure perceived susceptibility, severity, benefits, and barriers, a dichotomous perception scale (Agree and Disagree) was created. In the perception component of the questionnaire, there were a total of 23 test items. A right answer was scored 1, while a wrong answer scored 0. Therefore, every study participant's perception score was categorized between 0-11 as Code 1 and > 11-23 as Code 2. Respondents that score between 0-11= Code 1 were adjudged to have exhibited a poor perception of DM prevention, and > 11-23= Code 2 as having a good perception of DM prevention. Furthermore, perceived susceptibility was measured in an 8-point perception scale graded 0-4, with Code 1 being poorly perceived susceptibility to DM and >4-8=Code 2 as well perceived susceptibility to DM. In addition, the perceived severity of DM complications was measured on a 5-point perception scale graded

0-2, with Code 1 being the poor perceived severity of DM complications and >2-5=Code 2 as the well perceived severity of DM complications. Perceived benefits of DM prevention were measured in a 5-point perception scale graded 0-2, with Code 1 being poor perceived benefits of DM prevention and >2-5=Code 2 as good perceived benefits of DM prevention. In addition, perceived barriers to DM prevention were measured on a 60-point perception scale graded 0-3, with Code 1 being poorly perceived barriers to DM prevention and >3-6=Code 2 as well perceived barriers to DM prevention.

A dichotomous attitudinal scale (Agree, Disagree) was developed. The total number of test items in the attitude section of the questionnaire was eight items. A right answer was scored as 2, while a wrong answer was scored as 0. Therefore, every study participant's attitude score was categorized between 0-8 as Code 1 and > 8-16 as Code 2. Respondents that scored between 0-8=Code 1 were assumed to have exhibited a poor attitude towards DM prevention, and >8-16= Code 2 as having a good attitude towards DM prevention.

. The Department of Public and Community Health, Novena University, gave approval for the conduct of the study with reference number MEOW/9313/ Vol 1/10.

RESULTS

Socio-demographic characteristics of the respondents

According to Table 1 below, about half of the respondents 50(50.0%) were aged 13-15 years, while 59(59.0%) were females, and the majority 99(99.0%) were Christians. Furthermore, 32(32.0%) were in class SS 1. The majority of the respondents 88(88.0%) had heard of DM, and 22(22.0%) attributed their source of information on DM to family members. In addition, only a few of the respondents 18(20.5%) affirmed having a family member diagnosed with DM (Grandparent, Aunt, Uncle, or First Cousin but not own parent, brother, sister or child). Only a few of the respondents 17(19.30%) affirmed to have recently received training on the prevention of DM in the school and the majority affirmed to receive their training less than a year ago.

Table 1: Socio-demographic characteristics

Variables	Frequency (N=100)	Percentage %
Age		
10-12	28	28.0
13-15	50	50.0
16-18	22	22.0
Sex		
Male	41	41.0
Female	59	59.0
Religion		
Christianity	99	99.0
Islam	1	1.0
Class		
JSS 1	19	19.0
JSS 2	22	22.0
SS 1	32	32.0
SS2	27	27.0
Have you heard of diabetes mellitus		
Yes	88	88.0
No	12	12.0
If yes, what is your source of information		
Community	3	3.0
Radio	14	14.0
Television	15	15.0
Family Member	22	22.0
Health Worker	17	17.0
School	17	17.0
Has any member of your immediate family or other relatives been diagnosed with DM		
No	65	73.90
Yes: Grandparent, Aunt, Uncle or First Cousin (but not own parent, brother, sister or child)	18	20.5
Yes: Parent, Brother, Sister	5	5.70
Have you recently received training on prevention of DM in school		
Yes	17	19.30
No	71	80.70
If yes, when		
< 1 Year	14	82.40
> 3 years	3	17.60

Knowledge of Diabetes Mellitus

As shown in Table 2 below, there was a significant increase in post-test when compared with the pre-test in the mean knowledge of the definition and types of DM, causes of DM, signs and symptoms of DM, risk factors of DM, complications of DM, management of DM and prevention of DM. There was also a significant increase in the overall mean knowledge of DM from 5.42±2.79 at pre-test to 9.27±3.43 at post-test.

In Figure 1 below, the majority of the respondents (89.8%) demonstrated poor knowledge of DM at pre-test, and the level of knowledge of DM at post-test increased to 64.8%.

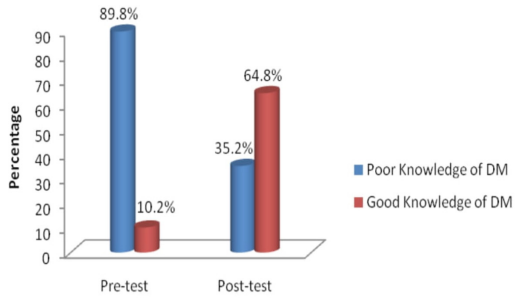

Figure 1: Level of Knowledge of DM among the respondents at Pre and Post-test

Perception of Diabetes Mellitus

In Table 3 below, there was a significant increase at post-test when compared with the pre-test in the mean perceived susceptibility, perceived severity, perceived benefits and perceived barriers towards DM prevention. There was also a significant increase in the overall mean perception of DM from 10.68±5.18 at pre-test to 14.77±5.53 at post-test.

Perception of Diabetes Mellitus

In Table 3 below, there was a significant increase in the post-test when compared with the pre-test in the mean perceived susceptibility, perceived severity, perceived benefits, and perceived barriers towards DM prevention. There was also a significant increase in the overall mean perception of DM from 10.68±5.18 at pre-test to 14.77±5.53 in post-test.

According to Figure 2 below, the majority of the respondents (64.8%) exhibited poor perception of DM at pre-test, and the level of improved perception of DM at post-test increased to 62.5%.

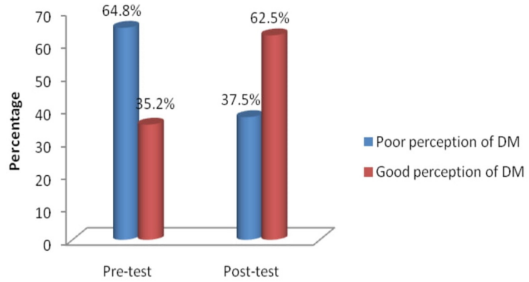

Figure 2: Level of Perception of DM Prevention at Pre and Post-test

There was a significant increase in the overall mean attitude towards DM from 3.32±2.63 at pre-test to 6.09±2.41 in the post-test (Table 3). In Figure 3 below, most of the respondents (72.7%) showed a poor attitude towards DM at pre-test, and the level of good attitude towards DM at post-test increased to 62.5%.

According to Table 4 below, the demographic predictors of knowledge were the class of the

Table 2: Knowledge of Diabetes Mellitus

Variable	Pre-test	Post-test	t-test	P-value	95% CI	
					Lower	Upper
Definition & types of DM	0.82±0.79	2.05±1.10	-8.930	0.000	-0.6113	-0.3887
Causes of DM	0.716±0.61	1.18±0.64	3.795	0.000	1.0825	0.3463
Signs and symptoms of DM	0.74±0.70	1.56±0.64	-7.334	0.000	-0.6211	-0.3562
Risk factors of DM	0.34±0.64	0.61±0.85	-2.484	0.015	-0.2659	-0.0295
Complications of DM	0.09±0.29	0.93±0.87	-6.708	0.000	-0.4419	-0.2399
Management of DM	1.24±0.86	1.88±0.33	-6.133	0.000	-0.4965	-0.2535
DM Prevention	1.01±0.79	1.53±0.69	-4.479	0.000	-0.4758	-0.1833
Overall Knowledge	5.42±2.79	9.27±3.43	-8.740	0.000	-0.6695	-0.4214

Table 3: Perception of Diabetes Mellitus

Variable	Pre-test	Post-test	t-test	P-value	95% CI	
					Lower	Upper
Perceived Susceptibility	2.51±1.54	3.76±1.55	-6.205	0.000	-0.5401	-0.2781
Perceived Severity	2.47±1.44	3.52±1.28	-3.525	0.001	-0.3909	-0.1091
Perceived Benefits	3.03±1.59	3.51±1.24	-1.878	0.064	-0.2807	0.0079
Perceived Barriers	2.67±1.48	3.97±1.62	-3.899	0.000	-0.4118	-0.1337
Overall Perception	10.68±5.18	14.77±5.53	-4.008	0.000	-0.4079	-0.1375
Attitude towards DM Prevention	3.32±2.63	6.09±2.41	-5.132	0.000	-0.4887	-0.2158

CI: Confidence Interval

respondents (AOR=4.362 95% CI=1.599-11.898) and family history of DM (AOR=2.469 95% CI=0.931-6.553). In addition, the predictors of perception were the class of the respondents (AOR=2.708 95% CI=1.572-4.664) and family history of DM (AOR=1.183 95% CI=1.633-5.714). Furthermore, the predictors of attitude were the class of the respondents (AOR=3.082 95% CI=0.475-2.382) and family history of DM (AOR=1.064 95% CI=0.475-2.382).

DISCUSSION

The study seeks to investigate the effects of teacher-led educational interventions on knowledge, perception and attitude toward diabetes mellitus among students of Dom-Domingos College Warri, Delta State. The majority of the students were aware of DM. The study's findings were similar to those of the study in Lagos State and another study in Oyo State, where the majority were aware of DM [11,24]. Furthermore, the majority of the students do not have any family members diagnosed with DM. This finding was lower than a previous study in Kuwait, where about 46.5% of the students had a family history of DM [25].

The findings of the study showed most of the students defined DM as too much sugar in the blood. This shows hyperglycemia is one of the characteristic ways of identifying DM.

Table 4: Predictors of Knowledge, Perception and Attitude towards DM Prevention

Variables	Wald	df	Sig.	COR	AOR	95 CI	
Knowledge						Lower	Upper
Age	3.478	1	0.062	0.061	0.121	0.013	1.114
Sex	2.481	1	0.115	0.275	0.278	0.056	1.367
Class	8.278	1	0.004	5.535	4.362	1.599	11.898
Family History of DM	3.296	1	0.069	3.011	2.469	0.931	6.553
Perception							
Age	2.809	1	0.094	0.404	0.403	0.139	1.167
Sex	0.169	1	0.681	0.808	0.812	0.302	2.188
Class	12.888	1	0.000	2.708	2.708	1.572	4.664
Family History of DM	0.194	1	0.660	0.983	1.183	0.560	2.497
Attitude							
Age	4.647	1	0.031	0.267	0.257	0.075	0.884
Sex	2.184	1	0.139	0.425	0.445	0.152	1.302
Class	12.777	1	0.000	3.086	3.082	1.663	5.714
Family History of DM	0.023	1	0.880	0.706	1.064	0.475	2.382

COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio

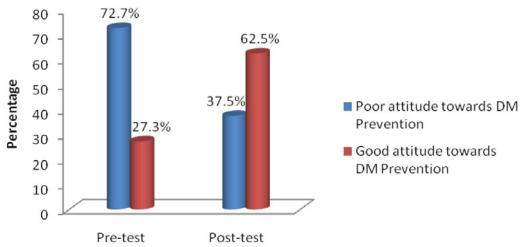

Figure 3: Level of Attitude towards DM Prevention at Pre and Post-test

This was similar to previous studies in Lagos and Delta States, Nigeria [11,14]. Similarly, about a quarter of the students affirmed not having any knowledge of the DM definition, highlighting a knowledge gap among the students at pre-test. The students demonstrated poor knowledge of types of DM, as the majority affirmed not knowing the types of DM. Few mentioned type 1, type 2, sugar, glucose, high sugar, and low sugar. This also represents a knowledge gap among the students at baseline. The knowledge of DM definition among the students improved at the post-test as most defined DM as too much sugar in the blood and a metabolic disorder in which blood glucose levels are abnormally high. In addition, the number of students who affirmed not knowing the definition of DM reduced from 25.0% to 5.7%. This improvement in knowledge could be attributed to the health education by the teachers. This finding was similar to that of a previous study [26]. Specifically, the knowledge of types of DM highlighted by the students at post-test increased for type 1 (2.8 to 23.9 at post-test) and type 2 (2.8 to 21.0 at post-test). In addition, some of the students mentioned gestational diabetes. This observed knowledge improvement was corroborated by the mean knowledge score of DM definition and types of DM which significantly increased after the educational intervention at post-test. The finding was similar to an educational intervention study in Nigeria, where knowledge of DM increased among school club members compared to non-members [23]. The study's finding was also similar to studies in South Africa, which showed increased knowledge after an educational intervention [27,28].

The students affirmed the causes of DM to eating excessive sugar and genetics. However, the majority also affirmed not knowing the causes of DM. This also indicates a knowledge gap on the causes of DM among the students at pre-test. The finding was similar to that of a previous study [29]. The proportion of students who did not have knowledge of the causes of DM decreased from 38.6% at baseline to 17.6% at post-test. In addition, specific causes of DM listed by the students included insulin resistance, family history, and a sedentary lifestyle. This shows knowledge improvement in post-test. This was similar to a previous study [26]. The mean knowledge score of the causes of DM increased at the post-test, which could be attributed to the health educational intervention by the teachers. This was similar to previous studies [24,27,28].

Some students listed the signs and symptoms of DM as glucose in the urine, weight loss, fatigue, and urinating frequently. However, some students affirmed not knowing the signs and symptoms of DM at baseline. The finding was similar to that of previous studies in Nigeria [11,29]. The students' signs and symptoms at the post-test were similar to that at pre-test. However, the proportion of students who affirmed not knowing the signs and symptoms decreased from 43.5% at baseline to 8.5% at post-test. This could also be attributed to the teachers' health educational program similar to previous studies [11,29,30]. About two-thirds of the students did not know the risk factors of DM at baseline. However, some mentioned eating food with high sugar, damage to parts of the body, and blindness. In the same vein, the number of students who confirmed not knowing the risk factors of DM decreased from 68.8% at baseline to 23.3% at post-test. This could also be attributed to the health education program, which showed an increase in the mean knowledge score of risk factors of DM. This was similar to previous studies [23,27,28].

In addition, the majority of the students did not know the complications of DM at baseline. Although, a few students listed death, illness, kidney failure, and loss of weight as complications of DM. This also highlights the knowledge gap among the students. Besides, the proportion of students who were not knowledgeable of DM complications at the post-test decreased from 79.5% at baseline to 28.4% at post-test, which was also substantiated by the mean knowledge score of DM complications which increased at the post-test. This could also be attributed to the health education program. This was similar to a previous study in Nigeria [26].

At baseline, more than one-third of the students affirmed not knowing the ways of DM management, while almost half of the students affirmed not having knowledge of DM prevention at baseline. This also highlights knowledge of DM management and prevention gap at baseline. However, in post-test the mean knowledge score for both DM management and prevention increased, which could be attributed to the health education program. This was similar to previous studies [23,27,28].

The overall knowledge of DM at post-test shows that 64.8% of the students demonstrated a good knowledge of DM as compared to 89.8% demonstrating poor knowledge of DM at baseline. This shows the teacher-led educational program increased the students' knowledge in the post-test. Furthermore, the mean knowledge score on post-test was higher than on pre-test, with an increase of 71.03%, and the difference was statistically significant. This was consistent with previous educational intervention studies [23,27,28].

A similar trend was also observed in the students' perception of DM. The students' perceived susceptibility also increased as 72.7% agreed that poor management of DM will not make DM patients vulnerable to DM complications at baseline, while at post-test, 62.5% disagreed. Furthermore, 75.0% agreed that DM patients who do not follow prescribed treatment guidelines are not susceptible to DM complications at baseline, while at post-test, 62.5% disagreed. In addition, 72.7% agreed that they did not believe they could have DM at baseline, while at post-test, 59.1% disagreed. All these changes in perceived susceptibility could be attributed to the health education program by the teachers, consistent with previous studies' findings [31,32].

Similarly, at baseline, 52.3% agreed that DM does not lead to death, 55.7% agreed that DM is not a serious illness and 55.7% disagreed that DM could lead to blindness, while at post-test, 62.5% disagreed that DM does not lead to death, 59.1% disagreed that DM is not a serious illness and 65.9% agreed that DM could lead to blindness. This could be attributed to the health education program by the teachers. This was also consistent with the findings of previous studies [31,32].

Furthermore, the perceived benefits and barriers to DM treatment and prevention also increased after the educational intervention program by the teachers. The students now perceived the importance of exercise and a healthy diet to DM prevention, while lack of knowledge of DM, faith healing, and lack of exercise was acknowledged as barriers to DM prevention after the health education program. The findings were consistent with other educational interventional studies, which improved study participants perceived benefits of DM and decreased their perceived barriers to DM, smoking, and AIDS preventive beliefs [31,33,34,35].

The overall perception at baseline shows that 64.8% of the students exhibited a poor perception of DM, while at the post-test, 62.5% exhibited a good perception of DM . Additionally, the mean perception score at post-test was higher than at pre-test, with an increase of 38.29%, which was statistically significant. This increase in improved perception could be attributed to the health education program. The findings were similar to that of previous studies [31,36].

The overall attitude towards DM showed that 72.7% exhibited a poor attitude towards DM at baseline while 62.5% demonstrated good attitude towards DM prevention at post-test. In addition, the mean attitude score at the post-test was higher than at pre-test, increasing by 80.72%. The increase was statistically significant. This increase could also have been attributed to the health educational interventional program. This was similar to that of a previous study [37]. Age and sex have been documented as significant predictors of knowledge from previous studies [38,39]. However, the current study showed both age and sex were not significant predictors of knowledge, perception, and attitude. This observed difference could be attributed to differences in study designs and population. The current study showed the class of study and family history significantly predicted the knowledge, perception, and attitude towards DM. This was corroborated by previous studies within and outside Nigeria [14,40,41,42].

One of the limitations of the study was that the study relied solely on the students' responses both at pre-test and post-test for analysis which could be limited because of the ages of the students. Additionally, the limitation of a one-group pre-test and post-test study could also affect the results of the study. This is because there was no control group to indicate that the training conducted for the students resulted in the observed changes in knowledge, perception, and attitude towards DM.

CONCLUSION

The study highlighted teachers' importance in improving students' knowledge, perception, and attitude towards DM prevention. According to the study, after the health education, the mean knowledge score of DM among the students increased from 5.42±2.79 at baseline to 9.27±3.43 at post-test. Furthermore, the overall mean perception score of DM increased from 10.68±5.18 at baseline to 14.77±5.53 at post-test. Similarly, the students' mean attitude towards DM prevention increased from 3.32±2.63 at baseline to 6.09±2.41 at post-test. Additionally, there was a significant association between the knowledge, perception, and attitude on pre-test and post-test, highlighting the importance of teacher-led health education in improving the students' knowledge, perception, and attitude. Therefore, the context of DM should be improved in the curriculum of secondary schools as this would lead to sustainable improvement in the knowledge of DM.

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